



Consortium for Advanced Radiation Sources CAT

Overview

The Consortium for Advanced Radiation Sources (CARS) currently has four institutional members—The University of Chicago (the managing agent for CARS), Northern Illinois University, Southern Illinois University, and the Australian Nuclear Science and Technology Organization—and four national user groups—BioCARS for structural biology, GeoCARS for geophysical sciences, SoilEnviroCARS for soil/environmental sciences, and ChemMatCARS for chemistry and materials science. At present, CARS has developed or is developing five x-ray beamlines for use by the faculty and staff of its institutional members and national user groups for frontier research that exploits the unique characteristics of the APS as an x-ray source.

Research Focus

The scientific program and experiments carried out on CARS beamlines exploit the unique features of the x-rays emitted by both wiggler and undulator sources. Two main themes are 1) the study of samples with which x-rays interact very weakly because of their small size (area or volume), low concentration, large crystallographic unit cell dimensions, or necessity for monochromatic radiation of unusually narrow bandpass and 2) time-dependent studies of samples with which x-rays interact more strongly. For **BioCARS**, the main thrust is to understand basic biological processes in structural terms. Experiments involve crystallographic studies of viruses, ribosomes, and other complexes with very large unit cells; studies of microcrystals; time-resolved crystallography; and phase determination by MAD techniques. In **GeoSoilEnviroCARS**, research is designed to further knowledge of the composition, structure, and properties of earth and planetary materials and the processes they control. High-pressure research in both a diamond-anvil cell and a large-volume press; x-ray diffraction, scattering, and absorption spectroscopies from earth and planetary materials; and x-ray fluorescence microprobe analysis and microtomography make possible major advances in understanding such diverse processes as earthquake development and nitrogen fixation in roots. In **ChemMatCARS**, research focuses on the chemistry and material properties of condensed matter in both the static and dynamic time domains. Research areas include surface and interfacial properties in soft condensed matter; molecular liquids and liquid metals; chemical crystallography with emphasis on dynamics of energy transfer, fast photochemical processes, and valence and element specific crystallography; the structure and properties of molecular aggregates; and interfacial and bulk properties of novel polymers and composites including supramolecular, mesoscopic, and nanometer structures.

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